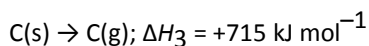
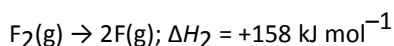
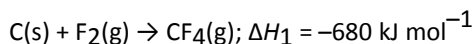


T05D06 – 5.4 IB Practice

Name.....

1. What energy changes occur when chemical bonds are formed and broken?
- A. Energy is absorbed when bonds are formed and when they are broken.
B. Energy is released when bonds are formed and when they are broken.
C. Energy is absorbed when bonds are formed and released when they are broken.
D. Energy is released when bonds are formed and absorbed when they are broken.
2. Given the following data:



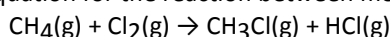
calculate the average bond enthalpy (in kJ mol^{-1}) for the C—F bond.

(Total 4 marks)

3. (a) Define the term *average bond enthalpy*, illustrating your answer with an equation for methane, CH_4 .

(3)

- (b) The equation for the reaction between methane and chlorine is



Use the values from Table 10 of the Data Booklet to calculate the enthalpy change for this reaction.

(3)

- (c) Explain why no reaction takes place between methane and chlorine at room temperature unless the reactants are sparked, exposed to UV light or heated.

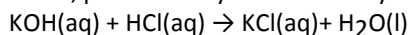
(2)

- (d) Draw an enthalpy level diagram for this reaction.

(2)

(Total 10 marks)

4. In aqueous solution, potassium hydroxide and hydrochloric acid react as follows.



The data below is from an experiment to determine the enthalpy change of this reaction.

50.0 cm^3 of a $0.500 \text{ mol dm}^{-3}$ solution of KOH was mixed rapidly in a glass beaker with 50.0 cm^3 of a $0.500 \text{ mol dm}^{-3}$ solution of HCl.

Initial temperature of each solution = 19.6°C

Final temperature of the mixture = 23.1°C

- (a) State, with a reason, whether the reaction is exothermic or endothermic.

(1)

- (b) Explain why the solutions were mixed rapidly.

(1)

- (c) Calculate the enthalpy change of this reaction in kJ mol^{-1} . Assume that the specific heat capacity of the solution is the same as that of water.

(4)

- (d) Identify the **major** source of error in the experimental procedure described above. Explain how it could be minimized.

(2)

- (e) The experiment was repeated but with an HCl concentration of $0.510 \text{ mol dm}^{-3}$ instead of $0.500 \text{ mol dm}^{-3}$. State and explain what the temperature change would be.

(2)

(Total 10 marks)

5. The reaction between ethene and hydrogen gas is exothermic.

- (i) Write an equation for this reaction.

(1)

- (ii) Deduce the relative stabilities and energies of the reactants and products.

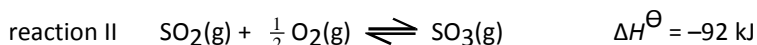
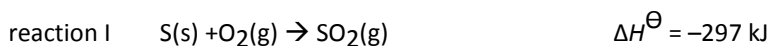
(2)

- (iii) Explain, by referring to the bonds in the molecules, why the reaction is exothermic.

(2)

(Total 5 marks)

6. Two reactions occurring in the manufacture of sulfuric acid are shown below:



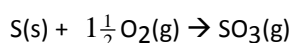
- (i) State the name of the term ΔH^\ominus . State, with a reason, whether reaction I would be accompanied by a decrease or increase in temperature.

(3)

- (ii) At room temperature sulfur trioxide, SO_3 , is a solid. Deduce, with a reason, whether the ΔH^\ominus value would be more negative or less negative if $\text{SO}_3(\text{s})$ instead of $\text{SO}_3(\text{g})$ were formed in reaction II.

(2)

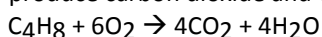
- (iii) Deduce the ΔH^\ominus value of this reaction:



(1)

(Total 6 marks)

7. But-1-ene gas, burns in oxygen to produce carbon dioxide and water vapor according to the following equation.



- (a) Use the data below to calculate the value of ΔH^\ominus for the combustion of but-1-ene.

Bond	C-C	C=C	C-H	O=O	C=O	O-H
Average bond enthalpy / kJ mol^{-1}	348	612	412	496	743	463

(3)

- (b) State and explain whether the reaction above is endothermic or exothermic.

(1)

(Total 4 marks)